

reached a height of twenty-three feet six inches, which is two inches higher than any previous high-water record. The observer states that this unprecedented height was due not so much to the amount of rainfall as to the recent construction of levees and closing of outlets, as the rains preceding the rise were not as heavy as have occurred in former years.

Lathrop, San Joaquin county: a levee on the San Joaquin river broke on the morning of the 18th, causing a damaging overflow.

Connecticut.—Hartford: on the 18th the Connecticut river was twenty feet above its average height. All docks below Middletown, Middlesex county, were overflowed.

Georgia.—Atlanta: the heavy rainfall on the morning of the 15th caused injury to the railroads in this vicinity.

Milledgeville, Baldwin county: the heavy rains of the 16th and 21st caused much damage to the soil prepared for the spring crops.

Rome, Floyd county: on the 17th, more than one-half of the houses in Rome were inundated by the overflow of the Oostanaula and Etowah rivers. The water reached a height thirty-nine feet six inches above low-water mark, which is within eleven inches of the height of the great flood of March 11, 1881, when the highest stage of water ever known at this place occurred. The flood began on the 14th, and on the 17th, the water continued to rise at the rate of two inches per hour. The flooding of the town caused a general suspension of business. The water and gas works were inundated; the post office was closed and the telegraph office was moved. Great damage was done to the farms along the river, many farmers having their newly planted corn and cotton swept away.

Kansas.—Atchison, Atchison county: on the 18th White Clay creek, which runs through this city, was swollen by the heavy rains to a greater height than ever before known. Residents in lower parts of the city had to abandon their homes, and several buildings were floated away. Numerous bridges in this vicinity were washed away.

Louisiana.—Franklin, Saint Mary's parish: the heavy rains of the 5th and 6th caused a rise of ten inches in the Teche river. On the 6th the river was twenty inches below high-water mark of 1874, and a number of plantations along its east bank were under water.

Opelousas, Saint Landry parish: the heavy rains of the 4th and 5th caused an overflow of the bayous in this vicinity.

Maine.—Portland: The rivers and streams in this vicinity were much swollen on the 17th; numerous bridges and much lumber were swept away.

Biddeford, York county: on the 18th the Saco river reached the highest stage that has occurred since 1870. Reports from Augusta state that all of the mills at that place were compelled to suspend work.

Calais, Washington county: the lowlands between this place and Princeton were under water on the 18th. All of the mills along the Saint Croix river were shut down, and a bridge at Baring, eighty feet in length was washed away.

Bangor, 18th: the high water in the Penobscot river damaged the Maine Central railroad bridge and washed away a part of the Freeze boom at Orono. On the 23d the river reached the highest stage that has occurred for fourteen years. Many thousand feet of logs were swept away.

Brunswick, Cumberland county: the Androscoggin river reached the highest stage that has occurred during the last ten years.

Ellsworth, Hancock county, 18th: the water in Union river reached the highest stage that has occurred for several years.

Missouri.—Joplin, Jasper county: the very heavy rainfall of the 28th cause the neighboring streams to rise rapidly. The mines in this region were flooded to such an extent as to delay work for several days.

New Hampshire.—Laconia, Belknap county: the heavy rains of the 17-18th caused the water in Lake Winnepesaukee to rise to a height several feet above high-water mark. A number of mills suspended work, and great fears for the safety of the dam at Lake Village were entertained.

Nashua, Hillsborough county: on the 18th the Merrimac river had reached a point ten feet above low-water mark and flooded a part of the city.

Hanover, Grafton county: the Connecticut river reached a high stage at this place on the 18th. The meadows and highways adjacent to the river were submerged.

Province of Quebec.—Montreal: the heavy rains on the night of the 15-16th, flooded the lower portions of this city. The water in the river rose to within six inches of the top of the revetment wall on the river front.

Tennessee.—Chattanooga: the heavy rains on the 14th caused much damage to the Western and Atlantic railroad by washing away the tracks.

Texas.—Longview, Gregg county, 21st: the recent heavy rains caused an overflow of the Sabine river. The lowlands were inundated and about two million feet of logs were floated away.

HIGH TIDES.

Galveston, Texas: the strong southerly gale on the 28th and 29th caused considerable damage to the east end of Galveston island by forcing the water from the Gulf far in shore. The high surf wrecked a number of portable bath-houses on the beach.

Bangor, Maine, 26th, 27th, overflowing the wharves.

New River Inlet, North Carolina, 22d to 26th.

Hatteras, North Carolina, 3d.

Fort Macon, North Carolina, 25th, 26th.

Cedar Keys, Florida, 12th, 15th.

Indianola, Texas, 4th, 17th, 19th, 30th.

LOW TIDES.

New River Inlet, North Carolina, 3d.

Cedar Keys, Florida, 6th, 9th, 25th.

Indianola, Texas, 21st to 25th.

VERIFICATIONS.

INDICATIONS.

The detailed comparison of the tri-daily indications for April, 1884, with the telegraphic reports for the succeeding twenty-four hours, shows the general average percentage of verifications to be 83.63 per cent. The percentages for the four elements are: weather, 86.56; direction of the wind, 79.70; temperature, 83.02; barometer, 86.55 per cent. By geographical districts they are: for New England, 76.72; middle Atlantic states, 83.09; south Atlantic states, 86.83; eastern Gulf states, 85.65; western Gulf states, 86.67; lower lake region, 82.81; upper lake region, 82.47; Ohio valley and Tennessee, 85.25; upper Mississippi valley, 84.90; Missouri valley, 82.39; north Pacific coast region, 90.74; middle Pacific coast region, 81.00; south Pacific coast region, 79.35. There were twenty-seven omissions to predict, out of 3,210 or 0.84 per cent. Of the 3,183 predictions that have been made, seventy-five, or 2.36 per cent., are considered to have entirely failed; one hundred and thirty-three, or 4.18 per cent., were one-fourth verified; four hundred and thirty, or 13.51 per cent., were one-half verified; five hundred and twenty-five, or 16.49 per cent., were three-fourths verified; 2,020, or 63.46 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

CAUTIONARY SIGNALS.

During April 1884, one hundred and sixty-six cautionary signals were ordered. Of these, one hundred and forty-four, or 86.75 per cent., were justified by winds of twenty-five miles or more, per hour, at or within one hundred miles of the station. Sixty-three cautionary off-shore signals were ordered, of which number, fifty-two, or 82.54 per cent., were fully justified both as to direction and velocity; sixty, or 95.24 per cent., were justified as to direction; and fifty-five, or 87.30 per cent., were justified as to velocity. Two hundred and twenty-nine signals of all kinds were ordered, one hundred and ninety-six, or 85.59 per cent., being fully justified. These do not include signals ordered at display stations, where the velocity of the

wind is only estimated. Of the above cautionary off-shore signals, forty-eight were changed from cautionary. Nine signals were ordered late. In sixty-seven cases, winds of twenty-five miles or more, per hour, were reported for which no signals were ordered.

TEMPERATURE OF WATER.

The temperature of water as observed in rivers and harbors during April, 1884, with the average depth at which the observations were made and the mean temperature of the air at the various stations, are given in the table below. Observations were interrupted by ice at the following stations: Alpena, Michigan, on the 1st; Buffalo, New York, 1st, 6th, 12th, 13th; Detroit, Michigan, 1st, 2d; Duluth, Minnesota, from 1st to 30th; Escanaba, Michigan, 1st to 16th; Mackinaw City, Michigan, from 1st to 18th; Marquette, Michigan, from 1st to 27th; Milwaukee, Wisconsin, 1st 2d, 3d. The highest water temperatures observed during the month were 83° 5 and 79° at Key West and Cedar Keys, Florida, respectively, on the 19th; the lowest were 30° 5 at Alpena, Michigan, on the 7th; 33° 1 at Escanaba, Michigan, on the 17th; and 33° 1 at Buffalo, New York, on the 14th and 30th. The largest monthly ranges were: 21° 1, Cedar Keys, Florida; 17° 7, Chincoteague, Virginia; and 17.5, Alpena, Michigan. The smallest monthly ranges were: 4° 9, Fort Canby, Washington Territory; 4° 6, Wilmington, North Carolina; 4° 3, Eastport, Maine; and 3° 2, San Francisco, California.

Temperature of water for April, 1884.

Station.	Temperature at bottom.		Range.	Average depth, feet and inches.	Mean temperature of the air at station.
	Max.	Min.			
Atlantic City, New Jersey.....	50.1	42.9	7.2	4 7	47.0
Alpena, Michigan*.....	48.0	30.5	17.5	11 6	37.3
Annapolis, Maryland.....	70.0	59.7	10.3	12 6	62.1
Baltimore, Maryland.....	56.6	44.9	11.7	9 8	52.3
Block Island, Rhode Island.....	46.1	37.0	9.1	8 4	42.9
Boston, Massachusetts.....	46.1	34.8	11.3	22 8	42.7
Buffalo, New York*.....	37.9	33.1	4.8	9 7	39.7
Canby, Fort, Washington.....	51.9	47.0	4.9	16 4	50.5
Cedar Keys, Florida.....	79.0	57.9	21.1	11 5	69.0
Charleston, South Carolina.....	68.2	62.0	6.2	41 10	63.3
Chicago, Illinois.....	48.0	38.5	9.5	8 4	44.3
Chincoteague, Virginia.....	60.0	42.3	17.7	4 9	48.8
Cleveland, Ohio.....	48.3	37.8	10.5	14 0	43.5
Detroit, Michigan*.....	48.2	37.0	11.2	22 11	45.5
Delaware Breakwater, Delaware.....	50.3	36.9	13.4	8 9	47.2
Duluth, Minnesota.....					
Eastport, Maine.....	37.7	33.4	4.3	16 3	39.9
Escanaba, Michigan*.....	41.4	33.1	8.3	15 0	36.3
Galveston, Texas.....	73.3	62.0	11.3	12 3	67.2
Grand Haven, Michigan.....	55.6	42.9	12.7	19 0	43.7
Indianapolis, Texas.....	74.5	61.0	13.5	9 2	67.5
Jacksonville, Florida.....	74.5	67.0	7.5	18 0	68.7
Key West, Florida.....	83.5	74.8	8.7	17 6	76.2
Mackinaw City, Michigan*.....	38.1	33.4	4.7	10 0	37.3
Macon, Fort, North Carolina.....	67.0	55.5	11.5	6 2	57.2
Marquette, Michigan*.....	36.3	35.0	1.3	9 11	35.6
Milwaukee, Wisconsin*.....	45.7	38.7	7.0	8 0	40.9
Mobile, Alabama.....	69.5	56.0	13.5	16 3	66.2
New Haven, Connecticut.....	49.3	35.9	13.4	15 8	44.9
New London, Connecticut.....	44.7	37.5	7.2	12 9	45.4
New York City.....	50.0	37.5	12.5	16 5	47.0
Norfolk, Virginia.....	60.2	50.0	10.2	17 1	54.5
Pensacola, Florida.....	71.5	64.1	7.4	17 5	66.3
Portland, Maine.....	43.0	34.4	9.2	16 9	45.7
Portland, Oregon.....	55.2	49.2	6.0	58 4	54.1
Sandusky, Ohio.....	52.0	39.0	13.0	11 2	44.9
Sandy Hook, New Jersey.....	47.0	39.8	7.2	1 5	47.2
San Francisco, California.....	58.2	55.0	3.2	38 10	55.0
Savannah, Georgia.....	66.7	60.3	6.4	10 7	65.3
Smithville, North Carolina.....	68.0	59.4	8.6	10 0	59.4
Toledo, Ohio.....	55.2	41.6	13.6	12 2	45.7
Wilmington, North Carolina.....	63.6	59.0	4.6	19 8	60.5

* Observations interrupted by ice: see text.

ATMOSPHERIC ELECTRICITY.

AUORAS.

An auroral display occurred during the night of the 24-25th, which was reported from the Missouri valley eastward to Nova Scotia, the most southern point at which it was observed, being in southern Indiana. The following reports relate to this display:

Portland, Maine: a brilliant aurora was observed at 1.50

a. m. of the 25th, consisting of numerous streamers reaching the zenith; the display was obscured by clouds at 2.30 a. m.

Eastport, Maine: aurora from 7.25 p. m., until 3. a. m. of the 25th.

Point Judith, Rhode Island: at 8.30 p. m. of the 24th, an auroral display was observed through the clouds, its influence being felt on the telegraph lines one hour before the display was observed.

Toledo, Ohio: an aurora of moderate brightness was observed from 10 to 10.30 p. m. of the 24th.

Wauseon, Ohio: a moderately brilliant aurora was observed at 9 p. m. on the 24th in the form of short streamers extending upward from a partial arch in the northern sky.

Sunman, Indiana: an aurora was visible at 10 p. m. of the 24th.

Port Huron, Michigan: a diffuse auroral light, with occasional streamers, was observed in the northern sky at 10.50 p. m. of the 24th.

Grand Haven, Michigan: a faint aurora was observed from 9.10 to 11.45 p. m. of the 24th.

Milwaukee, Wisconsin: a brilliant auroral display was observed from 9 to 10.15 p. m. of the 24th, consisting of slender luminous beams having a constant motion.

Sussex, Wisconsin: a beautiful auroral display occurred on the 24th. It first appeared as a dark cloud 10° above the horizon, with streamers and "dancers" extending upward to the zenith. The influence of the aurora on the magnetic needle was very noticeable. Surveyors report that on the morning of the 24th the declination of the needle change 45' to the west, and on the afternoon of that date the instrument became useless. The effects of the aurora upon the needle did not disappear until 3 p. m. of the 25th.

Beloit, Wisconsin: a brilliant auroral display was observed from 8.30 to 10 p. m. of the 24th. It first appeared in the north as a white light, which gradually developed into an arch with several broad bands extending towards the zenith. Later the arch moved upward and the broad bands were succeeded by narrow beams of a pinkish color.

Alpena, Michigan: an aurora was observed at 8 p. m., of the 24th, consisting of a diffuse light, resting upon a dark base of dense haze, in the northwestern sky; at 8.30 p. m. the whole sky except that along the southern horizon was covered with the haze; at 8.40 p. m. very brilliant streamers appeared in the southern sky, reaching an altitude of 25°, and having an apparent motion from east to west; at 11 p. m. the aurora gradually faded away, leaving only a diffused light on the northern horizon.

Fort Totten, Dakota: an auroral beam was observed at 7.45 p. m. in the southern sky, and passing about 5° south of the zenith, terminating in the northwest. This beam was from 2° to 3° in width near the horizon, but at an altitude of 30° it widened abruptly to 9°; at 10.30 p. m. shooting beams were observed in the south. The display ended at 11 p. m.

Dubuque, Iowa: a brilliant aurora was visible from 9.30 to 9.55 p. m., consisting of slender beams extending from a luminous base to a height of 30°.

Davenport, Iowa: a bright aurora was observed in the northwest from 8.30 to 10 p. m., the light extending to an altitude of 45°.

Huron, Dakota: brilliant auroral beams were visible from 8.30 p. m., of the 24th, until after midnight.

Fort Bennett, Dakota: a faint aurora was seen from 9.20 to 9.30 p. m., appearing as slender columns of pale straw-colored light.

Yankton, Dakota: a faint aurora, in the form of an arch, with parallel beams reaching nearly to the zenith, was observed from 9.10 to 9.45 p. m.

Other auroral displays were observed during the month, as follows:

5th.—Manitowoc, Wisconsin.

11th.—Woodstock, Vermont; Westerville, Ohio.

14th.—Cornish and Orono, Maine; Wellsborough, Pennsyl-